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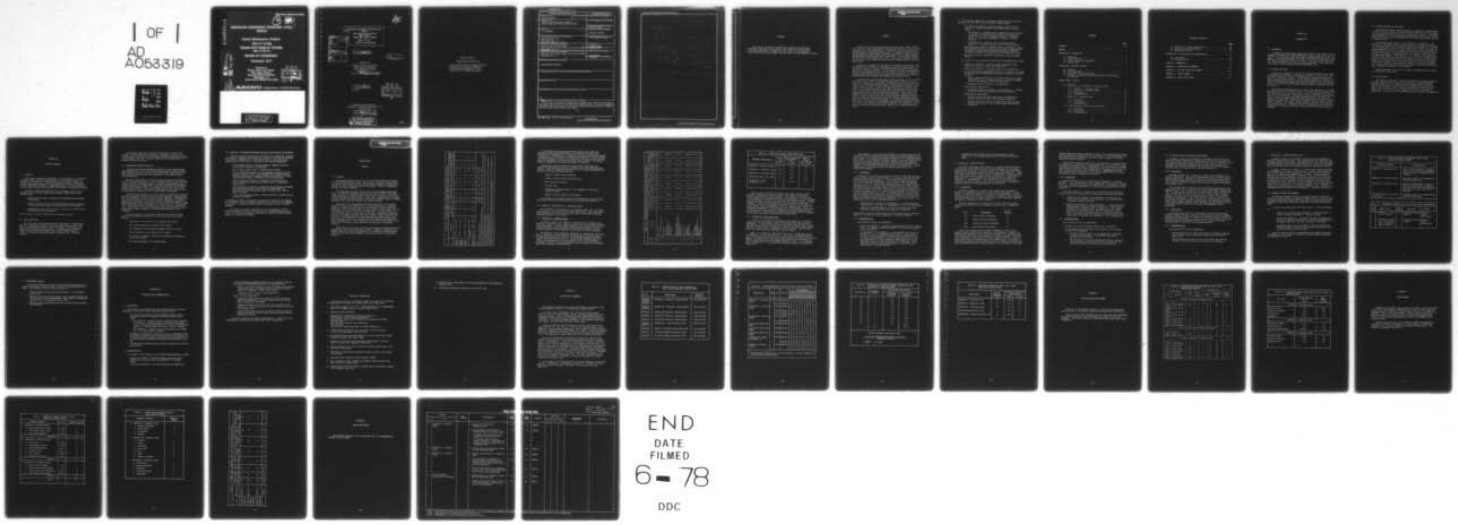

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DESTROYER ENGINEERED OPERATING CYCLE (DDEOC)

System Maintenance Analysis

DDG-37 CLASS

RADAR DATA DISPLAY SYSTEM

SMA 37-303-411

REVIEW OF EXPERIENCE

December 1977

Prepared for
Director, Escort and Cruiser
Ship Logistic Division
Naval Sea Systems Command
Washington, D. C.
under Contract N00024-78-C-4062

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This report, the Review of Experience, documents the historical maintenance experience for the DDG-37 Class Radar Data Display System. It has been developed for NAVSEA 934X, the sponsor of the Destroyer Engineered Operating Cycle (DDEOC) Program, under Contract N00024-78-C-4062.

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FOREWORD

This report, the Review of Experience, documents the historical maintenance experience for the DDG-37 Class Radar Data Display System. It has been developed for NAVSEA 934X, the sponsor of the Destroyer Engineered Operating Cycle (DDEOC) Program, under Contract N00024-78-C-4062.

SUMMARY

The goal of the Destroyer Engineered Operating Cycle (DDEOC) Program is to effect an early improvement in the material condition of ships, at an acceptable cost, while maintaining or increasing their operational availability during an extended operating cycle. In support of this goal, System Maintenance Analyses (SMAs) are being conducted for selected systems and subsystems of designated surface combatants. The principal element of an SMA is the Review of Experience (ROE). This report documents the ROE for the DDG-37 Class Radar Data Display System excluding the Navy Tactical Data System.

An ROE is an analysis of existing and anticipated problems that affect the operational performance or maintenance program of a ship system. The ROE report serves as a vehicle for assessing the significance and consequences of identified problems. It also presents specific recommendations and a system maintenance policy that will prevent or reduce the impact of problems while improving material condition and maintaining or increasing system availability throughout an extended ship operating cycle.

The Radar Data Display System ROE included an analysis of all available maintenance data sources. The documented maintenance experience of the system was reviewed through analysis of Maintenance Data System (MDS) data, Combat System Readiness Reviews (CSRRs), Casualty Reports (CASREPs), and system overhaul records. Initial findings from these sources were correlated with Planned Maintenance System (PMS) requirements, system alterations, system technical manuals, and findings of the FF-1052 Class Data Display System ROE to identify maintenance problems. Ship surveys were conducted and discussions were held with appropriate technical codes in order to validate identified problem areas, identify undocumented maintenance problems, and determine the status of current and planned actions affecting the Radar Data Display System. All findings were evaluated and conclusions were developed. Recommendations were then formulated to implement existing and newly defined corrective actions to minimize the occurrence of identified problems and their impact on the extended operating cycle.

The following significant conclusions resulted from this Review of Experience for the DDG-37 Class Radar Data Display System:

- The system has exhibited a high maintenance burden, which is expected to continue throughout an extended operating cycle unless:
  - The AN/SPA-4( ) Indicator Groups (especially those installed in the DDG-44 and DDG-45 pilot houses) are replaced with AN/SPA-25( ) or other refurbished AN/SPA-4( ) Indicator Groups; or the existing AN/SPA-4( ) are given a Class B Overhaul.
  - The AN/SPA-50( ) Indicator Group is replaced with an AN/SPA-25( ) Indicator Group or given a Class B Overhaul.
- Performance monitoring and material condition assessment criteria and performance monitoring procedures need not be developed for the Display System, because well-defined material condition assessment procedures and parameters are available and in use.
- The Display System is adequately supported by the Navy Supply System.

As a result of this analysis, the following recommendations are made:

- Replace the AN/SPA-4( ) Indicator Groups, especially those installed in the pilot house, with AN/SPA-25( ).
- Replace the AN/SPA-50( ) Indicator Group with an AN/SPA-25( ).
- If the replacements recommended above are not feasible, the following actions are recommended during Baseline Overhaul and succeeding ROHs.
  - Replace existing AN/SPA-4( ) with refurbished units removed from another ship, or accomplish Class B overhaul including repair or replacement of worn, frayed wiring.
  - Accomplish Class B overhaul of the AN/SPA-50( ).
- Other overhaul requirements:
  - Accomplish repairs as necessary to the AN/SPA-25( ) Indicator Groups and SB-1505/SP Radar Distribution Switchboard.
- Miscellaneous requirements:
  - Replace high-failure-rate components of the AN/SPA-50( ) Indicator Group with fewer, more reliable components.
  - Complete design and testing of solid-state radar selector switches and install in the SB-1505/SP Radar Distribution Switchboard.

CONTENTS

CONTENTS (continued)

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In support of the Destroyer Engineered Operating Cycle (DDEOC) Program, sponsored by NAVSEA 934X, System Maintenance Analyses (SMAs) are being conducted on selected systems and subsystems of program-designated surface combatants. The principal element of an SMA is the Review of Experience (ROE). This report documents the ROE for the DDG-37 Class Radar Data Display System, which was selected for analysis because equipments of this system are on the DDG-37 Class Maintenance Critical Equipment List.

1.2 PURPOSE AND SCOPE

An ROE is an analysis of existing and anticipated problems that affect the operational performance or maintenance program of a ship system. The ROE report serves as a vehicle for assessing the significance and consequences of identified problems. It also presents specific recommendations and a system maintenance policy directed toward preventing or reducing the impact of maintenance problems while improving material condition and maintaining or increasing system availability throughout an extended ship operating cycle.

The analysis documented herein is specifically applicable to the Radar Data Display System of the DDG-37 Class. Only those system components that had been installed or were aboard ship as of the fourth quarter of fiscal year 1976 were considered. The analysis used all available documented data sources from which system maintenance problems could be identified and studied. These included Maintenance Data System (MDS) and Planned Maintenance System (PMS) data; Combat System Readiness Reviews (CSRRs); Casualty Reports (CASREPs); and system overhaul records, alteration documentation, and technical manuals. Documented data were supplemented with information derived from discussions with Ship's Force and other cognizant technical personnel.

1.3 SYSTEM FUNCTION AND BOUNDARIES

The Radar Data Display System provides the equipment for distributing air search, surface search, and Identification Friend or Foe (IFF) signals to a plan position indicator (PPI) of a remote radar repeater. The Display System expands the PPI's capabilities by enabling the selection of any IFF display for remote viewing, provided that the indicator can accept the type of display desired.

The Display System consists of the AN/SPA-4( ), AN/SPA-25( ), and AN/SPA-50( ) Indicator Groups; a radar distribution switchboard; and various associated equipment, including dedicated test equipment. The AN/SPA-4( ) and AN/SPA-25( ) serve as general purpose PPIs in the pilot house and combat information center (CIC), where they provide azimuth and range for navigation and various other command and control and CIC functions including inputs to the NC-2 Plotting Table and the Underwater Battery Weapon Control System (UBWCS). The AN/SPA-50( ) is a direct-view, large-screen PPI used by CIC watch personnel for collision avoidance, navigation, and other CIC functions where a large screen display is desired. The switchboard can select and connect the IFF and radar sets to the various radar repeaters as required. Dedicated test equipment, including the AN/USM-115( ) Range Calibration Set, is used for preventive and corrective maintenance of Radar Data Display System equipment.

System components included in the analysis documented by this report are identified in Appendix A.

1.4 REPORT FORMAT

The remaining chapters of this report describe the analysis approach utilized (Chapter Two), briefly define significant system maintenance problems encountered and discuss potential problem solutions (Chapter Three), and summarize the conclusions and recommendations derived from this analysis (Chapter Four). Specific analyses and evaluations that support the results of the effort reported on herein are included in appendixes. A selected list of information sources precedes the appendixes.

CHAPTER TWO

ANALYSIS APPROACH

2.1 OVERVIEW

This chapter describes the approach to the performance of the ROE for the DDG-37 Class Radar Data Display System. Primary data sources are identified in Section 1.2. The data were used to identify, define, and analyze maintenance problems that will significantly affect the Display System's maintenance program. A recommended course of action relative to the maintenance program was formulated on the basis of the analysis results.

The Display System analysis began at the component level at which Allowance Parts List (APL) numbers are assigned. Major steps of the analysis were:

- Compilation of relevant documented and undocumented maintenance history data
- Analysis of these data to identify and define problems expected to have significant impact on the maintenance of the system
- Recommendation of specific courses of action for solution of the identified maintenance problems

Each of these activities is described in subsequent sections.

2.2 DATA COMPILATION

The first step in the analysis was the compilation of comprehensive data on the maintenance history of the Radar Data Display System. The data file generated consisted of four key elements: an MDS data bank, Combat System Readiness Reviews (CSRRs), a CASREP narrative summary, a system overhaul experience summary, and a system ShipAlt summary. A library of appropriate technical manuals, bulletins, etc., was also compiled.

All MDS data reported for the DDG-37 Class from 1 January 1970 through 31 October 1976 were screened for information relevant to the Display System. CASREP narrative summaries covered the period from 1 July 1973 through 30 June 1976. Overhaul experience was obtained from 3-M Mechanized Departure Reports.

2.3 MAINTENANCE PROBLEM DEFINITION

Potential maintenance problems associated with the Display System were identified by a screening process employing data obtained from the above-described sources as well as from ship surveys, discussions with Navy technical personnel and, when appropriate, from NAVSEA special interest programs.

MDS data constituted the initial and primary source of information used in the screening process. This data base includes all part and labor records, as well as narrative material, describing maintenance actions reported against system components. Maintenance actions are represented by Job Control Numbers (JCNs). The purpose of this first step in the screening process was to identify the maintenance actions that had been reported against components of the systems under investigation.

Computer-assisted analysis was next employed to quantify the man-hour and part-expenditure burdens incurred for each component. These calculations were performed not only for the selected components individually but also, as appropriate, for each generic class of components. Individual components or component classes that had contributed significantly to the system maintenance burden were selected for this purpose if they had generated a significant number of CASREPs or if other sources of information (e.g., ship surveys or overhaul experience) disclosed significant concern regarding maintenance problems or the maintenance programs for the components.

Detailed analysis of the selected components was directed toward defining each maintenance problem in terms of the following specific factors:

- The effect of the problem on the component and system
- The interval between occurrences of the problem
- The redundancy of the affected component within the system
- The criticality of the component to the system
- The resources required to perform the maintenance necessary to correct the problem
- The expected component or system downtime

2.4 ANALYSIS OF COMPONENT MAINTENANCE PROBLEMS AND DEFINITION OF SOLUTIONS

Once the component problems and their causes were identified, solutions were sought by examining each problem in relation to its extent of recognition and its susceptibility to established types of corrective action. These analysis criteria can be expressed in the following questions:

- Is the problem known to the Navy technical community and has a solution been proposed or established?
- Will a design change reduce or eliminate the problem?
- Is the problem PMS-related? Can the problem be reduced or eliminated by changes to PMS? (These changes might include adding or deleting requirements, changing requirement periodicity, or developing material condition assessment tests and procedures.)
- Can the problem be reduced or eliminated by improving Ship's Force, intermediate maintenance activity (IMA), or depot-level capabilities?
- Can the problem be reduced or eliminated by periodically performing restorative maintenance? Should this be accomplished at a Selected Restricted Availability (SRA) by Ship's Force, IMA, or depot facilities?
- Is the run-to-failure concept a viable maintenance strategy for the associated equipment?

An affirmative answer to any question resulted in analysis of the effects of the solution and in an estimate, when possible, of the cost to implement the solution. A negative answer prompted the analyst to go to the next question.

The historical overhaul experience for all installations of each selected component was then correlated with the recommended problem solutions. An evaluation was made to establish the Baseline Overhaul requirements for each selected component.

CHAPTER THREE

RESULTS

3.1 OVERVIEW

This chapter presents the results of the System Maintenance Analysis of the Radar Data Display System. The analysis, described in Chapter Two, resulted in the selection of five Display System components comprising 10 APLs as the major maintenance-burden contributors. Table 3-1 summarizes MDS data for these components.

The maintenance resource burden of three other Display System components, Switchboards SB-442/SP and SB-1109/SP and the AN/SPA-18 Indicator Group, was very low (combined burden was less than 5 percent of the overall system maintenance resource burden). These three components have not experienced a maintenance history that would portend problems during an extended operating cycle, and were excluded from further analysis.

Within the five major maintenance-burden components of the Display System, 165 parts were identified by the screening process as requiring analysis. Analysis revealed that 23 of these parts could be considered significant in terms of maintenance burden, number of replacements, or cost. These parts are listed in Table B-1 of Appendix B. Table B-2 shows the total reported usage for those generic part types considered to represent the major replacement burden in the three Indicator Groups (AN/SPA-4, -25, and -50). No significant parts usage was reported against the two other high-maintenance components, the SB-1505/SP Switchboard and AN/USM-115( ) Range Calibration Set. Parts determined to have the greatest impact on the repair rate of Display System components are discussed in subsequent sections.

CASREP analysis supported the MDS data screening by defining repetitive problems and significant maintenance actions. Appendix C summarizes the CASREPs submitted against the components of the Radar Data Display System, lists the parts that caused CASREPs, and shows the amount of associated downtime.

Table 3-1. MDS DATA SUMMARY OF SELECTED RADAR DATA DISPLAY SYSTEM APLs

APL	Nomenclature	Ships Reported	Total No. of Components	JCNs	Ship's Force Man-Hours	IMA Man-Hours	Total Man-Hours	Parts Cost (Dollars)	Total Component Operating Years	Average* Man-Hours/ Component Op. Yr.
56980305 56980315	AN/SPA-4( ) Indicator Group	10	28**	668	5,261	272	5,533	148,122	123.9	45
56982410 56982411 56982418	AN/SPA-25( ) Indicator Group	7	24**	216	2,692	158	2,850	39,879	91.2	31
56985001 56985005	AN/SPA-50( ) Indicator Group†	10	10	232	3,432	108	3,540	49,851	52.1	68
85215000	SB-1505/SP Radar Distribution Switchboard	5	5	32	254	0	254	11,650	26.0	10
58614100 58614101	AN/USM-115( ) Range Calibration Set	10	20	96	214	387	601	2,799	104.2	6
Totals				1,244	11,853	925	12,778	252,301		
Totals Reported for all System APLs				1,592	13,621	1,198	14,819	293,177		
Percent of Total Reported Accounted for by Selected APLs				78	87	77	86	86		

*The term "Total Component Operating Years" refers to the time the equipment was on board ship during the data period less the time the ship spent in overhaul, fitting out, or conversion.

**Due to the configuration changes of the AN/SPA-4( ) and AN/SPA-25( ) during the data period, these figures represent an average number of components on board throughout the data period.

†Field Change 4 converts the AN/SPA-50( ) to the AN/SPA-74 Radar Repeater. Since the resulting differences between these components are not significant, both repeaters will be treated under the heading of the AN/SPA-50( ) Indicator Group.

An evaluation of applicable Maintenance Index Pages (MIPs) and Maintenance Requirement Cards (MRCs) was conducted to determine the necessity of or desirability for changes to the PMS for the Display System. A comparison of the maintenance requirement periodicities with the reported corrective maintenance actions, and discussion with ship's force and technical code personnel, led to the conclusion that the PMS for the Display System is adequate and no additional checks are required.

Maintenance actions reported on Display System components were examined to determine which units or sections most often required repair, and why. Table 3-2 summarizes MDS data for the five high-maintenance components of the Display System, showing:

- Number of repair actions reported
- Number of repair actions requiring parts
- When failures discovered
- Failure cause
- Subsequent capability/status of the component in which the failure occurred
- Number of repair deferrals, and reasons

An estimate of the number of repair actions per year for each of the high-burden components was determined, and is presented in Table 3-3.

3.2 AN/SPA-4( ) AND AN/SPA-25( ) INDICATOR GROUPS

The AN/SPA-4( ) and AN/SPA-25( ) are general purpose PPIs, the former a tube type and the latter of solid-state construction. Since both equipments generally serve the same function on DDG-37 Class ships, they are discussed together in this report.

3.2.1 AN/SPA-4( ) Indicator Group

As shown in Table 3-2, a total of 527 repairs were performed on the AN/SPA-4( ) Indicator Group. Some 69 percent (361) of the repairs involved parts replacement. A review of MDS narratives and discussion with Ship's Force and technical code personnel indicated that the majority of the remaining repairs involved alignment and correction of wiring problems.

The AN/SPA-4( ) has required an average of 4.3 repairs per year, with most of the repair actions involving the replacement of electron tubes. Although these actions are numerous, the tubes are adequately spared and readily replaceable by Ship's Force. Review of MDS narratives did not isolate tube replacements to any individual section of the AN/SPA-4( ), but rather indicated a random replacement pattern throughout the equipment. CASREP data supported this observation.

Table 3-2. SELECTED MDS DATA FOR DDG-37 CLASS RADAR DATA DISPLAY SYSTEM

Item	Description	AN/SPA-4( )		AN/SPA-25( )		AN/SPA-50( )		SB-1505/SP		AN/USM-115( )	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
A	Number of Repairs	527	100	159	100	160	100	23	100	73	100
B	Number of Repairs Requiring Parts	361	69	108	68	111	69	19	83	29	40
C	When Discovered										
	During Operation	293	56	57	36	79	49	16	70	12	16
	During Inspection	65	12	52	33	24	15	4	17	6	8
	During PMS or System Test	47	9	16	10	14	9	0	0	26	36
	When Lighting Off	73	14	19	12	32	20	1	4	0	0
	Not Applicable	49	9	15	9	11	7	2	9	29	40
D	Cause										
	Normal Wear and Tear	381	72	82	52	106	66	16	70	24	33
	Manufacturing/Installation Defects	7	1	11	7	4	3	0	0	0	0
	Inadequate Instructions/Design	41	8	21	13	15	9	3	13	3	4
	Abnormal Environment	11	2	3	2	2	1	0	0	0	0
	Not Applicable	87	17	42	26	33	21	4	17	46	63
E	Capability/Status										
	Operational	91	17	61	38	35	22	9	39	14	19
	Nonoperational	217	41	36	23	88	55	5	22	13	18
	Reduced Capability	193	37	43	27	32	20	9	39	24	33
	Other	26	5	19	12	5	3	0	0	22	30
F	Deferrals	169	32	90	57	81	51	5	22	62	85
	Lack of Material	67	13	38	24	45	28	4	17	2	3
	Outside Assistance	33	6	35	22	14	9	0	0	57	78
	Work Backlog/Operation Priority	32	6	14	9	17	11	1	4	1	1
	Training	0	0	2	1	0	0	0	0	0	0
	Miscellaneous	37	7	1	1	5	3	0	0	2	3

Table 3-3. RADAR DATA DISPLAY SYSTEM REPAIR RATE

Equipment Nomenclature	Number of Repairs	Total Component Installation Time (Op. Year)	Number of Repairs Per Component (Op. Year)
AN/SPA-4( ) Indicator Group	527	123.2	4.3
AN/SPA-25( ) Indicator Group	159	91.2	1.7
AN/SPA-50( ) Indicator Group	160	52.0	3.1
SB-1505/SP Radar Dist. Swbd.	23	26.0	0.9
AN/USM-115( ) Range Calibration Set	73	104.0	0.7

MDS data and discussions with Ship's Force and technical support personnel indicated an increasing trend in the number of AN/SPA-4( ) repairs necessitated by wiring problems. An estimated 10 to 15 percent of all AN/SPA-4( ) maintenance actions are attributable to loose or exposed wires and numerous splices in the circuitry and wiring harnesses. Troubleshooting and repair of such casualties have been difficult and time-consuming. Ship's Force personnel state that overhauls of the AN/SPA-4( ) do not usually involve replacement of worn or frayed wiring. Thus it is reasonable to assume that the increasing trend of maintenance actions due to wiring problems will continue throughout an extended operating cycle unless there is a thorough wiring inspection and faulty wiring is repaired or replaced as necessary during BOH and succeeding ROHs.

3.2.2 AN/SPA-25( ) Indicator Group

A total of 159 repairs were performed on the AN/SPA-25( ) Indicator Group during the data period, of which 68 percent (108) involved parts replacement. A review of MDS narratives and discussion with Ship's Force personnel revealed that the majority of repairs not involving part replacement were relatively minor adjustments of the equipment. APL data indicated that repair parts are adequately spared on board.

Table C-3 of Appendix C shows that 87 percent of CASREP downtime for the AN/SPA-25( ) was in awaiting parts. This figure is somewhat misleading, since a large portion of the time awaiting parts was found to be attributable to requisitions for additional parts determined to be required at various times after the initial CASREP submission. Thus, it is concluded that the AN/SPA-25( ) has not experienced major problems in the supply of repair parts.

The AN/SPA-25( ) has required an average of 1.7 repairs per year (see Table 3-3), with the majority of repair actions within the capability of Ship's Force. It is worth noting that maintenance on the tube-type AN/SPA-4( ) must be at the repeater's location, usually in the pilot house or CIC. Both of these spaces are busy and dimly lighted during ship operations, resulting in poor maintenance access and increased time and effort in repairs. The solid-state circuit card concept of the AN/SPA-25( ) allows technicians to remove faulty cards and perform diagnostics in the electronics laboratory.

3.2.3 Conclusions

Comparison of the MDS data of Tables 3-2 and 3-3 shows that the maintenance resource burden of the AN/SPA-25( ) Indicator Group has been less than half that of the AN/SPA-4( ). The clearly indicated action of replacing the remaining 14 AN/SPA-4( )s in the DDG-37 Class with AN/SPA-25( )s is in fact being implemented through ShipAlt 1133, scheduled for completion by FY 82. However, discussions with technical support personnel indicate that the required number of AN/SPA-25( )s may not be available for the DDG-37 Class BOHs. Therefore, as a minimum, the AN/SPA-4( )s currently installed in the pilot house of DDG-44 and DDG-45 should be replaced with the AN/SPA-25( ). This is suggested because of the critical need for reliable radar repeaters in the pilot house for collision avoidance and navigation, and because the DDG-44 and DDG-45 are the only two ships of the DDG-37 Class not having AN/SPA-25( )s at that location. Two alternatives exist for the remaining AN/SPA-4( )s:

- Perform Class B overhaul of the AN/SPA-4( )s, including thorough inspection for, and repair or replacement of, worn or frayed wiring.
- Replace the existing AN/SPA-4( )s with refurbished units taken from other ships that have had AN/SPA-25( )s installed.

A determination should be made during the Pre-Overhaul Test and Inspection (POT&I) as to which of the two alternatives is the most feasible.

3.2.4 Recommendations

The following actions are recommended:

- Replace the AN/SPA-4( ) Indicator Group during BOH with the AN/SPA-25( ); as a minimum, replace the AN/SPA-4( )s in the pilot house of DDG-44 and DDG-45.
- If replacement of the AN/SPA-4( ) is not possible due to lack of AN/SPA-25( )s, it is recommended that either (1) the AN/SPA-4( ) be given a Class B overhaul, including thorough inspection for, and repair or replacement of, worn or frayed wiring; or (2) the existing AN/SPA-4( )s be replaced with refurbished units taken from other ships that have had AN/SPA-25( )s installed. The determination should be made during POT&I as to which of these alternatives is the most feasible.

- Perform maintenance during BOH and succeeding ROHs on the AN/SPA-25( ) as indicated necessary by the POT&I and the ship's CSMP.

3.3 AN/SPA-50( ) INDICATOR GROUP

On DDG-37 Class ships, the AN/SPA-50( ) Indicator Group functions as a large-screen radar display for use by watch personnel in the surface reporting area of the CIC. As shown in Table A-2, each ship in the DDG-37 Class has one AN/SPA-50A except for DDG-42, which has an AN/SPA-74. Since the AN/SPA-74 is essentially the same as the AN/SPA-50A in design and operation (the AN/SPA-74 was converted from an AN/SPA-50A by installation of Field Change 4), both equipments are discussed under the heading of AN/SPA-50( ). The AN/SPA-50( ) is a solid-state, large-screen radar repeater consisting of sweep, range, timing, and amplifier subassemblies and high- and low-voltage power supplies and regulators.

3.3.1 Discussion

As shown in Table 3-2, a total of 160 repairs were performed on AN/SPA-50( ) equipments installed in DDG-37 Class ships during the data period. Of these, 69 percent (111) involved parts replacement. Significant parts usage data are shown in Appendix B. Analysis of data indicated that the majority of the repairs not requiring parts replacement involved adjustment or alignment of the equipment.

MDS data revealed that the majority of repairs (about 65 percent) involving the AN/SPA-50( ) were performed on four units, as summarized below:

Unit	Description	No. of Repairs
600	Sweep Control Subassembly	11
700	Sweep Generator Subassembly	26
2100	Deflection Output Subassembly	32
2500	High Voltage Power Supply	34

Most of the repair actions involved replacement of tubes, semiconductor devices (diodes and transistors), and resistors. Analysis of Combat System Readiness Reviews (CSRRs) and CASREPs also pinpointed these part types as the cause of the majority of the repair actions. Since the circuit elements of these parts are direct-coupled, a failure of one part could cause failure of several others in the same circuit. Discussions with Fleet maintenance personnel disclosed that in many cases several parts must be replaced to repair a single casualty. This accounts for the large

average number of man-hours expended per repair (22, determined by dividing the total man-hours from Table 3-1 by the number of repairs from Table 3-2). These failures were random within the units, and not subject to failure forecasting through trending.

Ship's Force technicians stated that the AN/SPA-50( ) Indicator Group is frequently not used due to its high failure rate and the length of time required to accomplish repairs. NAVSECNORDIV is in the process of evaluating proposals to replace the high replacement rate parts in units 600, 700, 2100, and 2500 with fewer, more reliable parts. NAVSECNORDIV personnel have estimated that installation of the new part should result in a 50 to 60 percent increase in equipment reliability.

3.3.2 Conclusions

Data from Tables 3-2 and 3-3 show that the AN/SPA-50( ), like the AN/SPA-4( ), has a maintenance resource burden about twice that of the AN/SPA-25( ). Proposed alterations to the AN/SPA-50( ) are expected to improve its reliability and maintainability to about the same level as that of the AN/SPA-25( ).

Since the AN/SPA-50( ) presently has a relatively high maintenance resource burden, two alternatives are possible for resolving the problem:

a. Perform Class B Overhaul of the AN/SPA-50( ) during BOH, and install the alterations to the high repair rate units when the new material becomes available.

b. Replace the AN/SPA-50( ) with an AN/SPA-25( ). The efficiencies gained through integrated logistic support of a single type of non-NTDS radar indicator group, the AN/SPA-25( ); the greater reliability of the AN/SPA-25( ); and the requirement to have Ship's Force technicians experienced in the repair of only one type of indicator group could outweigh any small advantage of a second type of indicator, the AN/SPA-50( ), with a large screen.

3.3.3 Recommendations

The following actions are recommended:

- Replace the AN/SPA-50 Indicator Group with an AN/SPA-25.
- If replacement of the AN/SPA-50 is not feasible, the following actions are recommended:
  - Perform a Class B Overhaul of the AN/SPA-50( ) during BOH and each succeeding ROH. An estimated 65 man days is required for the overhaul.
  - Upon completion of circuit redesign and testing, replace as soon as possible the high-failure parts of units 600, 700, and 2100, and 2500 with fewer, more reliable parts.

3.4 SB-1505/SP RADAR DISTRIBUTION SWITCHBOARD

As shown in Table A-2 of Appendix A, each DDG-37 Class ship has one radar distribution switchboard. Switchboard SB-1505/SP is installed in five ships of the class, the SB-1109/SP in three, and the SB-442/SP in two. The reported maintenance resource burden on the latter two types was extremely low, and these equipments were excluded from further analysis. The SB-1505/SP is discussed in the following subsection.

3.4.1 Discussion

As shown in Table 3-2, a total of 23 repairs were performed on SB-1505/SP Switchboards. MDS parts replacement data did not reflect any significant parts usage. Analysis of these data and discussion with Ship's Force personnel indicated that most repairs are within the capability of Ship's Force and should not present any significant problems in extending the operating cycle.

The one major area of concern for the SB-1505/SP Switchboard is the radar selector switch. Failure of this switch necessitates a lengthy and difficult repair. Most technicians use an alternate (spare) channel whenever a casualty occurs and wait until an ROH or RAV to have the switch repaired. MDS data for this class ship do not confirm such a problem. However, this may be due to the relatively small amount of MDS data on SB-1505/SP Switchboards in DDG-37 Class ships. Additionally, discussions with technical support personnel indicated that the maintenance problems of the radar selector switches exist fleetwide, and the designing of a new solid-state selector switch is in process (NAVSEACENLANT and NRL, Washington).

3.4.2 Conclusions

Maintenance data for DDG-37 Class radar distribution switchboards revealed no major problems. However, discussions with technical support personnel indicated a potential problem in the radar selector switches for the SB-1505/SP Switchboard. To ensure continued high reliability of this switchboard during an extended operating cycle, the new solid-state switches should be installed as they become available.

3.4.3 Recommendations

The following actions are recommended:

- Perform repairs on the radar distribution switchboard during BOH and succeeding ROHs as determined necessary by the POT&I and ship's CSMP.
- Complete design and testing of the solid-state radar selector switches, and install them as soon as they are available.

3.5 AN/USM-115( ) RANGE CALIBRATION SET

As shown in Table A-2, each DDG-37 Class ship has two AN/USM-115( ) Range Calibration Sets on board. This equipment is a self-contained unit of modular design incorporating a temperature-controlled crystal for internal synchronization and accurate self calibration. A self test performed prior to each test is the only operator preventive maintenance required.

As shown in Table 3-2, a total of 73 repairs were reported performed on the AN/USM-115( ) during the data period. Of these, approximately 40 percent (29) required parts replacement. Analysis of parts replacement data did not identify any significant parts usage. The percentage of deferrals for outside assistance (78 percent, from Table 3-2) indicated, and discussion with Ship's Force personnel confirmed, that the majority of maintenance actions performed on this equipment are associated with calibration at an IMA. The data indicated a repair rate of less than one repair per year (see Table 3-3), and this equipment is not considered to present major problems during an extended operating cycle. Therefore, no recommendations are offered for the AN/USM-115( ) Range Calibration Set.

3.6 BASELINE OVERHAUL REQUIREMENTS

The Baseline Overhaul concept in the DDEOC Program is intended to ensure that ships entering an extended operating cycle will be in a state of material condition readiness such that there is a high probability of operation without major restorative maintenance throughout the extended cycle.

To achieve the stated ends of the BOH concept, it will be necessary to:

- Complete the conversion from AN/SPA-4( ) Indicator Groups, or Class B Overhaul the AN/SPA-4( ) Indicator Groups.
- Replace the AN/SPA-50( ) Indicator Group with the AN/SPA-25( ), or Class B Overhaul the AN/SPA-50( ), including installation of redesigned units 600, 700, 2100, and 2500, if available.
- Accomplish repairs to the AN/SPA-25( ) Indicator Groups and SB-1505/SP Radar Distribution Switchboard as determined necessary by the POT&I and ship's CSMP.

Table 3-4 presents specific recommendations for Baseline Overhaul. Recommendations for changes to the DDG-37 Class BOH Repair Requirements are presented in Table 3-5.

Table 3-4. BASELINE OVERHAUL REQUIREMENTS, DDG-37 CLASS RADAR DATA DISPLAY SYSTEM

Component/Equipment	Recommendation
AN/SPA-4( ) Indicator Group	Replace with AN/SPA-25( ) Indicator Grp. or with a refurbished AN/SPA-4( ) Indicator Group; or perform Class B Overhaul.
AN/SPA-25( ) Indicator Group	Accomplish repairs as recommended by POT&I and ship's CSMP.
AN/SPA-50( ) Indicator Group	Replace with AN/SPA-25( ) Indicator Group or perform Class B Overhaul including installation of redesigned units 600, 700, 2100, and 2500 if available.
SB-1505/SP Radar Distribution Switchboard	Accomplish repairs as recommended by POT&I and ship's CSMP.

Table 3-5. RECOMMENDED CHANGES TO DDG-37 CLASS BOH REPAIR REQUIREMENTS

SWBS	Repair Item	Qty/ Ship	Rationale	Remarks
41	6. AN/SPA-25( ) Radar Class C repairs.	0-6	System Maintenance Analysis	Addition to Repair Requirements
	4. SB-1505/SP, SP-442/ SP, or SB-1109/SP Radar Switchboard Class C repairs.	1	System Maintenance Analysis	Change to Repair Requirements

3.7 MAINTENANCE CONCEPT

The current maintenance concept of the Radar Data Display System of DDG-37 Class ships is consistent with the goals and constraints of the DDEOC. The principal aspects of that strategy are:

- Routine preventive and corrective maintenance at the organizational level.
- Technical assistance and IMA support from established support and IMA facilities, including NAVSEACENs, MOTUs, FMAGs, and destroyer tenders (such as that provided by the CSRR).
- Equipment repairs determined necessary by POT&I during scheduled ship overhauls.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The following significant conclusions resulted from this Review of Experience for the DDG-37 Class Radar Data Display System:

- The system has exhibited a high maintenance burden, which is expected to continue throughout an extended operating cycle unless:
  - •• The AN/SPA-4( ) Indicator Groups (especially those installed in DDG-44 and -45 pilot houses) are replaced with AN/SPA-25( ) or other refurbished AN/SPA-4( ) units; or the existing AN/SPA-4( ) Indicator Groups are given a Class B Overhaul.
  - •• The AN/SPA-50( ) Indicator Group is replaced with an AN/SPA-25( ), or given a Class B Overhaul.
- Performance and monitoring condition criteria, performance tests, and material inspections and procedures need not be developed for the Radar Data Display System, because well-defined material condition assessment procedures and parameters are available and in use.
- The Radar Data Display System is adequately supported by the Navy Supply System.

4.2 RECOMMENDATIONS

As a result of this analysis, the following recommendations are made:

- Replace the AN/SPA-4( ) Indicator Groups, especially those installed in the pilot house, with AN/SPA-25( ) Indicator Groups.
- Replace the AN/SPA-50( ) Indicator Group with an AN/SPA-25( ).

- If the replacements recommended above are not feasible, then the following are recommended during BOH and succeeding ROHs:
  - •• Replace the existing AN/SPA-4( ) with refurbished units removed from another ship, or accomplish Class B Overhaul including repair or replacement of worn, frayed wiring.
  - •• Accomplish Class B Overhaul of the AN/SPA-50( ).
- Other overhaul requirements.
  - •• Accomplish repairs indicated necessary by POT&I and ship's CSMP to the AN/SPA-25( ) Indicator Group and the SB-1505/SP Radar Distribution Switchboard.
  - •• Complete redesign of units 600, 700, 2100, and 2500 of the AN/SPA-50( ), which replace high failure rate parts with fewer, more reliable parts.
  - •• Complete design and testing of solid-state selector switches and install them in the SB-1505/SP Radar Distribution Switchboard when available.

To assist in monitoring the ROE recommendations, a list of the recommendations is presented in the DDEOC Action Table in Appendix D.

SOURCES OF INFORMATION

The specific sources of information used as the basis for the Review of Experience of the Radar Data Display System are listed below.

1. Trip Report (August 15-17, 1977), ARINC Research visit to NAVSECNORDIV MOTU-2, USS FARRAGUT (DDG-37), and USS DEWEY (DDG-45).

2. NAVSHIPS Technical Manuals:

   0967-087-9010, Azimuth-Range Indicator AN/SPA-4( )
   0967-445-8010, Indicator Group AN/SPA-25B( )
   0967-905-4010, Radar Signal Distribution Switchboard SB-1505/SP
   0967-091-5010, 0967-091-5020, 0967-205-1010 } Indicator Group AN/SPA-50( )
   0967-905-3010, Range Calibrator Set, Model AN/USM-115( )

3. CASREP Narrative Summaries for the period 1 July 1973 through 30 June 1976; FMSO Report 4400.28 Series.

4. Maintenance Requirement Cards (MRCs) as listed on Radar Data Display System Maintenance Index Pages (MIPs).

5. Generation IV MDS Part and Maintenance Data for DDG-37 Class for period 1 January 1970 through 30 October 1976.

6. Ships' Equipment Configuration Accounting System (SECAS) Report 502.1 for DDG-37 Class ships.

7. NAVSECNORDIV Combat System Readiness Reviews for DDG-37 Class ships, 1975 and 1976.

8. Applicable Ship Alteration Repair Packages (SARPs).

9. Type Commander's COSAL, SURFLANT and SURFPAC, dated 28 April 1976 and 23 June 1976, respectively.

10. CASREP Summary Retrieval Reports, SUP 4400.28 for the period 1 January 1972 through 30 April 1975.

11. Allowance Parts Lists (APLs) for selected components of the Radar Data Display System.

12. 3-M Mechanized Departure Reports for the DDG-37 Class.

APPENDIX A

SYSTEM MAJOR COMPONENTS

This appendix identifies the principal components considered in the System Maintenance Analysis of the Radar Data Display System.

For major items of equipment in the Radar Data Display System, Table A-1 lists the associated APL numbers, equipment nomenclature, and technical manuals. Table A-2 shows the current configuration of these equipments as derived from Ship's Equipment Configuration Accounting System (SECAS), Total Fleet Configuration Report, Type Commander COSAL data, CSRR reports, and MDS records for DDG-37 Class ships.

During the MDS data period covered by this ROE, seven DDG-37 Class ships (DDG-37, -38, -39, -40, -42, -43, and -46) reported changes to the Radar Data Display system configuration. These changes involved replacing AN/SPA-4( ) Indicator Groups with AN/SPA-25( ) types. No data were reported for the USS KING (DDG-41) following the conversion commencing 28 February 1974. The remaining two ships, DDG-44 and -45, retained the AN/SPA-4( ).

Due to the configuration changes in the Radar Data Display System during the data period, an exact equipment-installation time for the AN/SPA-4( ) and AN/SPA-25( ) could not be established. However, an approximation of this time was determined for each equipment from MDS data. The dates of radar repeater replacements were estimated from data presented in the MDS narratives, and from JCN information (including part replacement data) for each of the equipments. From these dates, individual ship equipment installation times were multiplied by the average number of equipments on board during the interval, and these figures were then summed to provide a total equipment installation time. The total equipment time was divided by the number of equipments on board to determine the average equipment installation time.

As an example, the computations for the average equipment installation time for the AN/SPA-4( ) is presented in Table A-3. The APLs and equipment installation time used as the basis of this ROE are shown in Table A-4.

Table A-1. IDENTIFICATION OF MAJOR EQUIPMENTS IN DDG-37 CLASS RADAR DATA DISPLAY SYSTEM

APL No.	Nomenclature	Technical Manual No.
56894801 56980305 56980315	AN/SPA-4( ) Indicator, Range-Azimuth	0967-087-9010
56982410 56982411	AN/SPA-25( ) Indicator, Range-Azimuth	0967-221-3010
56982418	AN/SPA-25B Indicator, Range-Azimuth	0967-445-8010
56985001	AN/SPA-74, Indicator, Range-Azimuth	0967-205-1020
56985005	AN/SPA-50A Indicator, Range-Azimuth	0967-091-5020
58614100 58614101	AN/USM-115( ) Range Calibrator Set	0967-905-3010
85244200	SB-442( )/SP Radar Distribution Swbd.	Not Available
85211091	SB-1109/SP Radar Distribution Swbd.	Not Available
85215000	SB-1505/SP Radar Distribution Swbd.	0967-965-4010

Table A-2. CONFIGURATION DATA FOR DDG-37 CLASS DATA DISPLAY SYSTEM

Nomenclature	SWBS	EIC	APL/CID	Hull Numbers									
				DDG-37	DDG-38	DDG-39	DDG-40	DDG-41*	DDG-42	DDG-43	DDG-44	DDG-45	DDG-46
AN/SPA-4( ) Indicator Group	411	P704	56980305				1	2		1		4	
		P706	56980315					1		1	4		
AN/SPA-25( ) Indicator Group		P70L	56982410	4						2			4
		P70M	56982411		1	4			4				
		P73K	56982418	2	4		4			2			2
AN/SPA-50( ) Indicator Group		P71L	56985001					1					
		P716	56985005	1	1	1	1	1		1	1	1	1
SB-1505/SP Radar Dist. SWBD		P90U	85215000	1	1	1					1		1
SB-1109/SP Radar Dist. SWBD		P90T	85211091				1			1		1	
SB-442/SP Radar Dist. SWBD		P90R	85244200					1	1				
AN/USM/115( ) Range Calibrator Set		WK57	58614100	1	1	1	1	2	1		1	2	1
			58614101	1	1	1	1		1	2	1		1
AN/SPA-18 Indicator Group		P70J	56981700	1	1	1	1	1	1	1	1	1	1

*Configuration reported prior to 1974 conversion. No data available on post conversion configuration.

Table A-3. COMPUTATION OF AVERAGE EQUIPMENT INSTALLATION TIME FOR AN/SPA-4() INDICATOR GROUP

DDG Hull No.	Equipments On Board	Installation Time (years)	
		Individual Equipment	Total Ship Equipment
37	3	4.3	12.9
38	2	4.2	8.4
39	2	4.9	9.8
40	3	4.7	14.1
41	4	3.4	13.6
42	1	2.7	2.7
43	2	4.2	8.4
44	4	5.8	23.2
45	4	4.4	17.6
46	3	4.4	13.2
	28		123.9

Average Equipment Installation Time

$$= \frac{\text{Total Ship Equipment Installation Time (Yrs)}}{\text{Equipment On Board}}$$

$$= \frac{123.9}{28} = 4.4 \text{ Years}$$

Table A-4. EQUIPMENT INSTALLATION TIME, DDG-37 CLASS RADAR DATA DISPLAY SYSTEM

Nomenclature	Average Components On Board	Equipment Installation Time (years)	
		Total	Average
AN/SPA-4( ) Indicator Group	28	123.9	4.4
AN/SPA-25( ) Indicator Group	24	91.2	3.8
AN/SPA-50( ) Indicator Group	10	52.1	5.2
SB-1505/SP Radar Dist. Swbd.	5	26.0	5.2
AN/USM-115( ) Range Calibration Set	20	104.2	5.2

APPENDIX B

MDS PART USAGE DATA SUMMARY

Table B-1 of this appendix presents a listing of the significant parts, related to a given APL, derived from the screening of MDS data.

Table B-2 shows total reported usage for those part types considered to cause the majority of the replacement part burden for the radar repeaters. The totals include the contributions from those parts listed in Table B-1.

Table B-1. SIGNIFICANT PARTS USAGE DATA FOR DDG-37 CLASS RADAR DISPLAY SYSTEM

Part Identification		Cost Per Unit (Dollars)	Replacement Parts			
NIIN	Nomenclature		Total Part Population	Number Replaced	Ratio (X100) of Parts Replaced to Total Population	Number of Ships Reported
AN/SPA-4( ) Indicator Group (APLs 56980305, 56980315)						
1080252	Electron Tube 3B28	4.11	56	201	359	10
1078147	Electron Tube 829B	12.98	140	265	189	10
1346031 1346064 8795079	Electron Tube 6AS6	.89	168	182	108	10
1793252 5427182 5431001	Electron Tube 6080	4.31	168	351	209	10
1794446 7525892	Electron Tube 12AT7	.77	364	1182	325	10
1880820	Electron Tube 2C53	9.85	28	31	111	8
5034880	Electron Tube OA2	.84	56	77	138	10
6244718	Electron Tube OB2	.89	112	209	187	10
6366294	Relay Armature	25.89	112	41	37	7
6696861	Electron Tube 6BA6	.65	28	39	139	6
AN/SPA-25( ) Indicator Group (APLs 56982410, 56982411, 56982418)						
0117110	Transistor	2.71	48	19	40	4
7090499	Electron Tube	26.00	24	7	29	4
8554281	Cathode Ray Tube	78.33	24	11	46	6
AN/SPA-50( ) Indicator Group (APLs 56985001, 5698005)						
0824043	Transitor 2N2377	8.19	20	27	135	4
1935087	Electron Tube 1B3GT	.95	20	30	150	6
8377262	Transitor 2N697	0.32	70	211	301	10
8467338	Transitor 2N1358	2.05	50	74	148	7
8817380	Variable Resistor	155.28	10	8	80	6
8839177	Transistor 2N2212	4.50	80	238	298	10
8920921	Electron Tube	771.00	10	4	40	3
8978418	Electron Tube	14.91	10	11	110	5
9462027	Electron Tube 6BK4	3.52	10	17	170	7
9516296	Transistor 2N1142	3.25	20	30	150	7

Table B-2. SIGNIFICANT USAGE BY PART TYPE FOR DDG-37 CLASS INDICATOR GROUP

Part Type	Average Reported Cost Per Unit	Total Number Replaced
AN/SPA-4( ) Indicator Group		
Electron Tubes	2.45	2549
Resistive Elements	0.86	251
Transformer	46.80	29
Capacitor	0.79	76
AN/SPA-25( ) Indicator Group		
Resistive Elements	11.23	71
Semiconductors	2.26	241
Printed Circuit Boards	384.43	42
AN/SPA-50( ) Indicator Group		
Electron Tubes	44.68	113
Resistive Elements	9.41	104
Semiconductors	1.02	992

APPENDIX C

CASREP SUMMARY

CASREPs for the DDG-37 Class, covering the period 1 July 1973 through 30 June 1976, were analyzed to determine the types of critical failures experienced by the Radar Data Display System. A total of 33 CASREPs were analyzed. Table C-1 shows the number of CASREPs reported against the various equipments and components that constitute the Display System. Table C-2 lists the part types reported as causing the CASREPs of the Indicator Groups.

CASREP correction times for the submitted CASREPs were examined to determine the average time required to effect repairs to CASREP major equipment and to determine whether parts supply problems exist. The results are presented in Table C-3.

Table C-1. SUMMARY OF CASREPs FOR DDG-37 CLASS RADAR DATA DISPLAY SYSTEM

Equipment/Component	Unit	CASREPs Reported
1. AN/SPA-4( ) Indicator Group		
a. High Voltage Power Supply	600	1
b. Low Voltage Power Supply	500	1
c. Yoke Drive Assembly	800	4
Subtotal		6
2. AN/SPA-25( ) Indicator Group		
a. Gear Train	1A7A1	2
b. Sweep Phase Detector	1A7A3	1
c. Cursor Phase Detector	1A8	1
d. N-S Yoke Driver	1A11	2
e. Power Supply	1A13	2
f. Variable Delay Line	1A14	1
Subtotal		9
3. AN/SPA-50( ) Indicator Group		
a. Sweep Control Assembly	600	1
b. Sweep Generator Subassembly	700	4
c. Deflection Output Subassembly	2100	8
d. High Voltage Power Supply	2500	5
Subtotal		18
Total		33

Table C-2. TYPES CAUSING CASREPs FOR DDG-37 CLASS INDICATOR GROUPS

Equipment Component	Number of CASREPs
1. AN/SPA-4( ) Indicator Group	
a. Resistive Elements	1
b. Synchro Motor	2
c. Transformer	2
d. Unknown	1
2. AN/SPA-25( ) Indicator Group	
a. Resolver	2
b. Filter	1
c. Transistor	2
d. Delay Line	1
e. Gear	1
f. Tube	1
g. Resistive Element	1
3. AN/SPA-50( ) Indicator Group	
a. Transistors	9
b. Resistive Element	6
c. Capacitor	1
d. Cathode Ray Tube	1
e. Transformer	1

Table C-3. SYSTEM CASREP CORRECTION TIME, DDG-37 CLASS RADAR DATA DISPLAY

APL	Nomenclature	Days Down Total	Days Down Maint.	Days Down Supply	Number of CASREPs	Avg. Days Down per CASREP	Avg. Days NORS per CASREP	Percent Down Due to Maintenance	Percent Down Due to Supply
56980305 56980315	AN/SPA-4( )	194	90	103	6	32	17	45	54
56982410 56982411 56982418	AN/SPA-25( )	204	26	176	9	22	20	13	87
56985001 56985005	AN/SPA-50( )	814	435	379	18	45	21	53	47
TOTALS		1,209	551	659	33	37	20	46	54

APPENDIX D

DDEOC ACTION TABLE

This appendix summarizes action information for the recommendations discussed in this report.

1. ACTION ITEM *		2. DDEOC EVALUATION **	3. ACTION ITEM DESCRIPTION	4. REPORT REFERENCE (PARA.)
a. NO.	b. TITLE			
1.	AN/SPA-4( ) Indicator Group		1. Replace with AN/SPA-25( ) Indicator Group	3.2
			2. If replacement with AN/SPA-25( ) Indicator Group not feasible, then: (1) Replace with refurbished unit removed from another ship, or: (2) Perform Class B overhaul including repair or replacement of frayed, worn wiring during ROH and succeeding ROHs.	3.2
2.	AN/SPA-25( ) Indicator Group		1. Perform repairs as necessary during BOH and succeeding ROHs.	3.3
3.	AN/SPA-50( ) Indicator Group		1. Replace with AN/SPA-25( ) Indicator Group.	3.3
			2. If replacement with AN/SPA-25( ) Indicator Group not feasible, then perform Class B overhaul during BOH and succeeding ROHs.	3.3
			3. Replace high failure rate components of units 600, 700, 2100, and 2500 with fewer, more reliable components.	.3
4.	SB-1505/SP Radar Distribution Switchboard		1. Perform repairs as necessary during BOH and succeeding ROHs.	3.4
			2. Complete design and testing of solid-state radar selector switches and install in switchboard.	3.4

* NOTE 1: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5 (IF KNOWN); 6a, IF REQUIRED FOR CONTIN
** NOTE 2: DDEOC EVALUATION – APPROVED, FURTHER STUDY REQ'D, ETC.
† NOTE 3: RESPONSIBILITY – ACTIVITY RESPONSIBLE FOR TAKING THE ACTION.

SHIP CLASS: DDG-37

SMA NO: 37-303-411

SYSTEM: Radar Data Display

OC ACTION TABLE

4. REPORT REFERENCE (PARA.)	5. RESPONSIBILITY †	6. SCHEDULING DATES a. REQD.	b. START	c. COMP.	7. REMARKS, FUNDING IMPLICATIONS, ETC.	8. ACTUAL ACTION TAKEN
3.2	NAVSEA					
3.2	NAVSEA					
3.3	NAVSEA					
3.3	NAVSEA					
3.3	NAVSEA					
3.3	NAVSEA					
3.4	NAVSEA					
3.4	NAVSEA					

OR CONTINUATION OF DEVELOPING ACTIVITY TASK; 7, AS NECESSARY.